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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
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| 10/530,322 | 04/05/2005 | Atsushi Watanabe | US01-04071PCT | 3070 |
| 21254 7590 01/09/2008 MCGINN INTELLECTUAL PROPERTY LAW GROUP, PLLC 8321 OLD COURTHOUSE ROAD SUITE 200 VIENNA, VA 22182-3817 | | | EXAMINER DURBIN, MICHAEL H | |
| | | | ART UNIT 2815 | PAPER NUMBER |
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/530,322

Applicant(s)

WATANABE ET AL.

Examiner

Michael Durbin

Art Unit

2815

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 25 September 2007.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1 and 4-6 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1 and 4-6 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 05 April 2005 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. **Claims 1 and 4-6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nagahama et al. (US 2005/0121679 A1) (hereinafter Nagahama), and further in view of Kano (US 6,388,275 B1).**

Regarding claims 1, 5, and 6: Nagahama discloses (embodiment 2, col. 18-col. 25) and shows (fig. 2) a group III nitride semiconductor light-emitting element, a GaN based LED, including an n-type contact layer of GaN doped with Si (12, col. 20, lines 22-24), and n-type clad layer of AlGa_N doped with Si (14; col. 21, lines 18-23), and active layer (16), a p-type clad layer (19), and a p-type contact layer (20), comprising a crack-preventing layer of InGa_N doped with Si (13; col. 20 line 66 – col. 21 line 15) of n-type GaN-based materials, having a lower dopant concentration than that of the n-type contact layer (col. 20; lower to confine carriers in the contact layer, col. 20, lines 33- 42; though this refers to the cladding layer, the crack preventing layer has the same physical concerns if included between the cladding layer and the contact layer, in order to confine carriers in the contact layer for lower resistivity), provided between the n-type contact layer (12) and the n-type clad layer (14).

Nagahama does not explicitly disclose the limitation such as the use of a GaN crack-preventing buffer layer wherein the crack prevention layer has a dopant concentration within a range of $5 \times 10^{16} / \text{cm}^3$ to $5 \times 10^{17} / \text{cm}^3$.

Kano teaches the replacement of an InGaN-type crack preventing layer with a superlattice-type crack-preventing buffer layer (5; col. 4, lines 18-27) formed of both materials that compose the n-type contact layer and the n-type clad layer (col. 1, line 30 – col. 2, line 44).

Kano is evidence that ordinary workers in the art would find a reason, suggestion, or motivation to use a crack-preventing layer with a superlattice.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the structure imparted by Nagahama by using a crack-preventing layer with a superlattice, since Kano teaches this improvement is more closely matches the two lattice constants (between GaN and AlGaIn) than does a crack-preventing layer of InGaIn (col. 1, lines 30-43).

When applied to the device of Nagahama, layers of GaN and AlGaIn are stacked alternating in composition so that the crack-preventing buffer layer is provided. This concept, when applied the GaN:Si and AlGaIn:Si layers, the resulting crack prevention layer may be considered to be a GaN crack preventing layer, as it comprises GaN. Alternatively, if each layer in the crack-preventing buffer layer is considered to be its own crack preventing layer, then the claimed crack-preventing layer may be the first GaN layer of the periodic structure.

Still lacking from Nagahama as modified by Kano is the n-type contact layer within a range of $5 \times 10^{16} / \text{cm}^3$ to $5 \times 10^{17} / \text{cm}^3$. The concentration of dopants is a results effective variable, as this system may be adjusted to increase carriers in the contact layer, allow for ohmic contact and acceptable threshold voltages, and to select the optimum range of leakage current and series resistance (evidenced by disclosure of Nagahama; col. 20, lines 24 - 38).

Thus, these claims are prima facie obvious without showing that the claimed ranges achieve unexpected results relative to the prior art range. In re Woodruff, 16 USPQ2d 1935, 1937 (Fed. Cir. 1990). See also In re Huang, 40 USPQ 2d 1685, 1688 (Fed Cir. 1996) (claimed ranges of a results effective variable, which do not overlap the prior art ranges, are unpatentable unless they produce a new and unexpected result which is different in kind and not merely in degree from the results of the prior art). See also In re Boesch, 205 USPQ 215 (CCPA) (discovery of optimum value of result effective variable in a known process is ordinarily within the skill of art) and In re Aller, 105 USPQ 233 (CCPA 1955) (selection of optimum ranges within prior art general conditions is obvious).

Further, this dopant concentration range would be less than any preferred dopant concentration in the contact region. Thus, the contact region will have a greater dopant concentration than the crack preventing layer, even if Applicant can show that the greater concentration is not required to confine carriers in the contact layer.

Regarding claim 4, Nagahama discloses that the contact layer may have a dopant concentration of range of $1 \times 10^{17} / \text{cm}^3$ to $1 \times 10^{21} / \text{cm}^3$, preferably range of

$1 \times 10^{18} / \text{cm}^3$ to $5 \times 10^{19} / \text{cm}^3$, overlapping the claimed range of $4 \times 10^{18} / \text{cm}^3$ to $2 \times 10^{19} / \text{cm}^3$.

In the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art" a prima facie case of obviousness exists. In re Wertheim, 541 F.2d 257, 191 USPQ 90 (CCPA 1976); In re Woodruff, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir. 1990).

Response to Arguments

3. Applicant's arguments filed 09/25/2007 have been fully considered but they are not persuasive.

4. Applicant asserts that the claimed range of range of $5 \times 10^{16} / \text{cm}^3$ to $5 \times 10^{17} / \text{cm}^3$ is not disclosed by Nagahama. However, as explained in the rejection above, the dopant concentration in the contact region is a result effective variable, and thus the claimed range is obvious absent a showing of unexpected results.

5. Applicant further states that one of ordinary skill in the art would not dope a crack preventing layer in this range due to the increase in resistance. However, it has been established that lower dopant concentrations have benefits (better crystal quality and lower leakage) as well as drawbacks (increased resistance), and that this range is available to be optimized by an individual skilled in the art.

6. The concept of having a contact layer with a low dopant concentration is not claimed, but rather a range which Applicant asserts in arguments is low. Regardless, the dopant concentration in the contact layer has been established as a result effective variable and is obvious absent a showing of unexpected results.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michael Durbin whose telephone number is (571) 272-9766. The examiner can normally be reached on M-T 7:30-5; 1st Fri. of biweek off, 2nd 7:30-4.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ken Parker can be reached on (571) 272-2298. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Michael Durbin
Examiner
Art Unit 2815

MHD

Matthew C. Landau
Matthew C. Landau
Primary Examiner